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SOME ASPECTS ON ADULT POPULATION AND OVIPOSITION OF CAPNODIS TENEBRIONIS (LINNAEUS) (COLEOPTERA: BUPRESTIDAE) IN CHERRY ORCHARD NEAR LARBAA NATH IRATHEN (GRANDE KABYLIE)

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ABSTRACT

This study was conducted in an orchard of cherry to Larbaa Nath Irathen infested by *Capnodis tenebrionis* in order to determine the duration of the presence of adults in the orchard and the oviposition period of this species. Early adult onset is observed on May 10 in 2009, their presence is observed until October this year. The maximum number of adult registered during August with a total of 55 individuals, the peak is observed on the 11th of this month represented by 19 individuals. These results allowed us to focus research in 2011 on changes in the number of adult populations with average mean temperature for each sampling week. Indeed, the emergence of adults was observed at an average weekly mean temperature equal to 16.4° C. The number of adults increases with increasing temperature, the maximum (29 individuals) was recorded on July 28 at 26.5° C. Above 26.5° C, the number of individuals decreases. In 2009, the duration of oviposition was 82 days from mid-June to the first week of September. The maximum egg is recorded on August 9 (596 eggs).The incubation period of eggs is 17 days at 30 ± 2°.

KEYWORDS: *Capnodis tenebrionis*, Mean Temperature, Oviposition, Incubation Period, Larbaa Nath Irathen, Cherry Orchard

INTRODUCTION

Capnodis tenebrionis is the species of the genus Capnodis most harmful to stone fruit the Mediterranean basin and neighboring regions. Its range extends to the Middle East, the Middle East and Central Asia (MARTINEZ DEL ALTUBE & al. 2007). The European Community has registered this pest on the list of pests that destroy the quality of propagating material of stone fruits (MARANNINO & al. 2008). Adults partially defoliate trees nuclei,destroy buds and dissect tender shoots. The damages caused by the larvae are much more important. It result in the drilling of galleries located either at the base of the trunk or the collar, or in large roots; which quickly perish infested trees. The damage caused by this insect have been reported in several countries, namely Spain (Garrido, 1984 SANCHEZ-CAPUCHINO et al 1987.), Italy (VIGGIANI, 1991), Turkey (TEZCAN 1995) Morocco (Chrestian 1955; MAHHOU and DENIS, 1992), Algeria (MARTIN, 1951), Palestine (Ben Yehuda and Mendel, 1997). The aim of the present work is to specify the period of onset of adults, the duration of their presence in the orchard, and the start of the oviposition periods under field conditions. It is from these data that we could eventually propose a suitable method of control against this pest in the study area.

METHODOLOGY

The present work was carried out in cherry orchard at Irdjen (36° 39'0 "N, 4° 10'0" E) in the region of Larbaa

Nath Irathen. The site is located at 720 m of altitude. The plantation date in 2002 on a surface of 0, 8 ha. Larbaa Nath Irathen is situated in a dampness bioclimatic level with temperate winter.

The study on adult populations was conducted over two years: 2009 and 2011. In 2009 we tried to determine the early onset and duration of the presence of adult *C. tenebrionis* in the orchard. Weekly prospecting are carried out on 25 trees, from early spring until fall. The insects were collected using the method of direct capture (by hand). Adults captured in 2009 were brought back to the laboratory to measure it. The year 2011 was devoted to study the evolution of the number of adults with ambient temperatures from April to November. For this, we calculated the average mean temperature for each week of sampling in order to determine the range in which the adults of *C. tenebrionis* are active.

Genitalia of *C. tenebrionis*

The preparation of genitalia consists in detaching carefully with fine forceps abdominal extremity of adults of C. tenebrionis then placed on solution of potash at 10% on electric hot plate for 10 minutes to isolate sclérotinised parts. The genitalia are rinsed with distilled water, separated from the digestive tract and placed in three alcohol baths (70°, 90° and 100°). Genital parts are spread between slide and cover slip in a drop of Faure liquid.

Oviposition Period and Number of Eggs Laid by Females of *C. tenebrionis*

Due to difficulty in tracking the evolution of egg laying of Capnodis tenebrionis in soil we found it useful to create adult conditions close to their natural environment. To specify the date of onset of egg laying and its duration, we proceeded according to the method described by GARRIDO *et al*, (1987). 10 pairs of adults of C. tenebrionis are placed in a cage (50x50x50 cm) in the orchard. The cage bottom is covered with paper (extra white) on which we introduced a thin layer of soil to create suitable conditions for oviposition. Adult of *C. tenebrionis* were fed with cherry twigs (containing leaves). Checking oviposition was performed every day before it started. Eggs laid were collected weekly by sieving soil through a sieve (0.8 mm) then measured and photographed under the binocular loupe at magnification 63 X.

Incubation Period of the Eggs of *C. tenebrionis*

In the laboratory, 10 couples were placed in a cage in the same conditions described previously to monitor oviposition in the orchard. The eggs laid are placed in Petri dishes containing filter paper covered with a thin layer of soil at 10 eggs per box. Five boxes are considered as replicates, each Petri dish receives 10 eggs. This test was conducted under controlled conditions at a temperature of 30 ± 2° C and a relative humidity of 60 ± 5%. After hatching, the larvae neonates were measured and photographed under a dissecting microscope at a magnification of 63 X.

RESULTS AND DISCUSSIONS

Morphometric Data

Measurements were performed on 50 individuals. The length of the females of *C. tenebrionis* ranges between 17 and 26 mm, the calculated mean is 21.48 ± 2.4 mm, the average width of prothorax is 9.55 ± 0.16 mm. The length of males varies between 16 and 24 mm, with a mean of 19.9 ± 2.12 mm. The average width of the prothorax is 8.598 ± 0.32 mm. TEREZA GARCIA et al. (1996) reported that the length of females is between 18 and 27 mm with an average of 25.2 mm, males between 18 and 25 mm with an average of 22.5 mm. Bonsignore et al (2008) indicated that the length of the females of this species was 24.26 ± 0.53 mm and the width of the prothorax is 9.73 ± 0.24 mm for males length is 22.68 ±

0.39 m, the width of the prothorax is 9.04 ± 0.18mm. According to Balachowsky (1962), the difference in size between the individuals of *C.tenebrionis* is attributed to biotic factors such as the quality of food received by the larva during its growth and can also be due to the existence of biological races.

Eggs of *C.tenebrionis* are milky white and cure rapidly on contact with air (figure 1). The average length to 30 eggs laid in cage was 1.38 ± 0.086 mm and an average width of 0.991 ± 0.038 mm. According to BONNEMAISON (1962), egg *C. tenebrionis* measure 1.5 x 1.2 mm. Our results are different from those obtained by MANAR FAWZI and NA'IM (2010) who noted that the average length of eggs of *C.tenebrionis* in Jordan is 5.7 ± 0.098 mm and the average width is 3.6 ± 0.080 mm.

The length of 20 neonate larvae fluctuates between 3.1 and 3.5 mm with a mean of 3.28 ± 0.13 mm. Neonate larvae are soft, white or cream (figure 2). The dorsal side of prothorax is provided with two grooves that form a V.

Male Genitalia of *C. tenebrionis*

The male genitalia of *C. tenebrionis* are composed of a median lobe (penis), a phallobase (proximal portion) which is terminated with two lateral appendices called parameres surrounding the penis (figure 6a).

DÜNGELHOEF and SCHMITT (2010), indicated that in some families of beetles such as Curculionidae and Chrsysomelidae, the penis is surrounded by the tegmen, this latter forms the entire phallobase and parameres. It is the case in the species of *C. tenebrionis*.

Female Genitalia of *C. tenebrionis*

Female genitalia of *C. tenebrionis* include several pieces (Figure 6b). At the extremity, there are two valves surrounding the ovipositor. In the middle of this latter we find the canal of the copulatory bursa. For this species, the ovipositor has an extension called auger laying. According to DUPUIS (2005), the egg-laying organ of female beetles which lay their eggs in the soil is constituted of an extension in form of a gutter called auger laying that allows guiding eggs outwards. The device combines auger laying and ovipositor is an adaptation to a mode of laying in a solid or semi-solid substrate.

Period of Presence of *C. tenebrionis* in the Orchard

Sampling adults of *C. tenebrionis* during 2009 given the results shown in Figure 1. The early onset of adult *C. tenebrionis* is observed on May 10. The duration of the presence of adults in the orchard was about 6 months, from May until the first decade of October. The maximum number of adult registered during August with a total of 55 individuals, the peak was observed on the 11th of the month represented by 19 individuals with an average of 12 ± 5.43 per week. The total captured during July is 47 adults. The number of individuals sampled varies from 9 and 16 individuals which gives an average of 11.75 ± 3.4 per week. The appearance of adults in May coincides with favorable climatic conditions to the activity of this species and availability of tender vegetation. GAIRAUD and BESSON (1950,) reported that in Mitidja release adults begins in April and increases gradually as the season advances. According to MARTIN (1950), adults are rarely observed in the plantations during winter in Algeria. Our results differ from those of GARRIDO (1984), who reported the presence of *C. tenebrionis* from February on apricot trees in Spain.

GARCIA *et al*. (1996) observed adults of this insect on cherry from April in Spain. Our results confirm those obtained by GARRIDO (1984), GARRIDO and MALAGON (1989) and Garcia et al. (1996), who reported that the

maximum of adult is captured during July and August, this period coincides with the appearance of adults of the new generation.

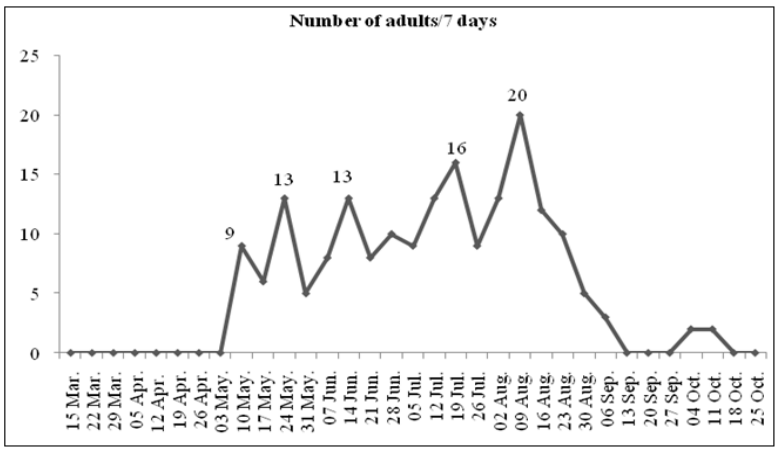

Figure 1: Period of Presence and Evolution in the Number of Adult of *C. tenebionis* in the Orchard

Evolution of the Number of Adults with Mean Temperature

In 2011, the number of adults reached its first peak in the second week of July (22 individuals) with an average mean temperature of the week sampling equal to 24.9° C. The maximum individuals of *C. tenebrionis* is recorded on July 28 (29 individuals) at an average weekly mean temperature equal to 26.5° C, The maximum number of individuals is recorded on July 28 (29 individuals) with an average weekly mean temperature equal to 26.5° C, another peak for this month is observed on July 14 represented by 25 individuals captured at 25.6°. The adult of *C. tenebrionis* are reduced at temperatures that range between 16° C and 21° C number and when the average temperature average is above 26.5° C. and when the average temperature average is above 26.5° C. Adult of *C. tenebrionis* disappeared completely in the orchard when average weekly temperatures are below 16° C and during rainy days (May and October). Evolution of the number of adults with average temperaturesThe disappearance of adults is also associated with falling leaves which constitute a food source for the adults of this species, observed from the first week of November. According to BALACHOWSKY (1962), the activity of the adult is null below 15° C, very low between 15° C and 20° C, it is only from 25° C during hot and sunny hours that *C. tenebrionis* activity is at its maximum. Indeed, GARCIA and al. (1996), reported that the maximum adult is captured when the average temperatures are above 20° C for one month.

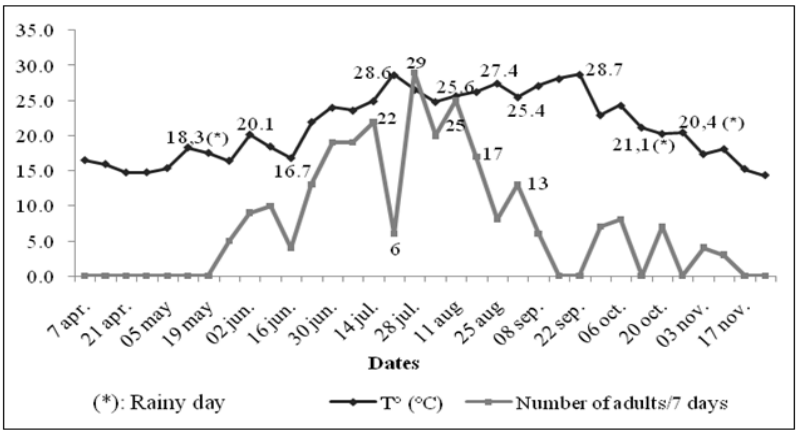

Figure 2: Variation in the Number of Adults of *C. tenebrionis* with Average Temperatures

Oviposition Period and Evolution of the Number of Eggs Laid by Females of *C. tenebrionis*

First egg laying were recorded June 14 with 198 eggs. The duration of the oviposition is long (82 days). The total number of eggs laid is 3438 eggs. Curve evolution shows three peaks: the first is observed on June 28 with 308 eggs, the second is noted on July 19 with 417 eggs and the third peak is observed on August 9 the number 596 which is the maximum eggs laid during this period. A decline in the number of eggs is remarkable from August 23, oviposition ceases from the first week of September. DEL CAÑIZO (1951), Balachowsky (1962), GARRIDO and al. (1987) and MALAGON (1989) explain that *C. tenebrionis* be obliged to go through a period of active life and diet before they mate and lay. These authors add that the first eggs appear in the ovarian ducts in June and the start of the egg laying coincides with rising temperatures above 25° C. Our results are similar to those obtained by GARCIA and al. (1996) noted that in Spain, oviposition of *C. tenebrionis* in cages starts in late June and continues until the end of August. MALAGON et al. (1990), reported that the minimum temperature for achieving the egg laying is around 25° C, the optimum is noted at 30° C.

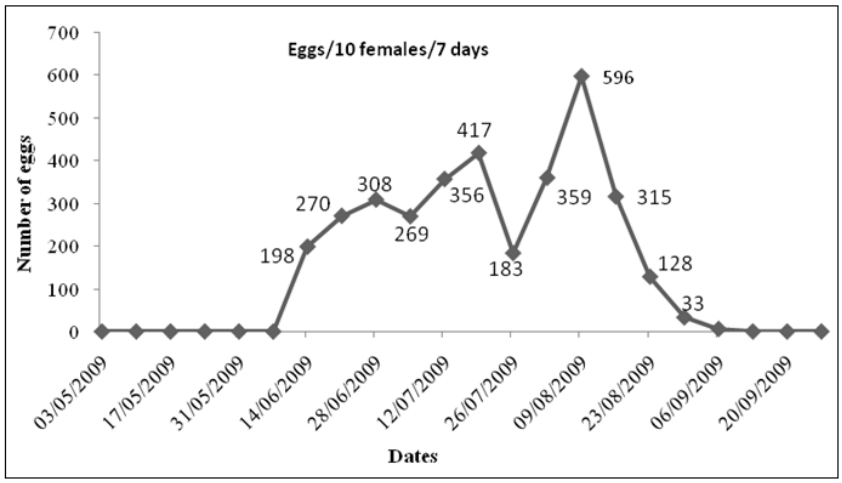

Figure 3: Number of Eggs Laid by Females of *C. tenebrionis* in 2009

Incubation Period of the Eggs of *C. tenebrionis*

The egg incubation period of *C. tenebrionis* in laboratory conditions is 17 days. The early hatching is observed on 12th day with an average of 14.5 ± 1.87 days. The hatching rate calculated for 50 eggs is 45%. According BALACHOWSKY (1962), the incubation eggs *C. tenebrionis* duration varies with the weather conditions, it is 12 to 13 days at a mean temperature value situated between 28 and 30° C and a relative humidity of 65%. According BONNEMAISON (1962), the incubation period is 11 days at an average temperature of 27.5° C and 25 days at the temperature of 21° C. MANAR and NA'IM (2010), reported that the duration of incubation eggs of *C. tenebrionis* is 19 days at 28° C.

Table 1: Duration of Incubation and Hatching Percentage of Eggs of *C. tenebrionis*

Duration of Incubation (Days)	0 à 11	12	13	14	15	16	17
Number of eggs hatched	0	4	7	12	8	8	6
Cumulative pourcentage	0	8,8	24,3	50,9	68,6	86,3	100

CONCLUSIONS

Study on adult populations and oviposition of *Capnodis tenebrionis* allowed us to determine the period of adult presence and duration of egg laying in the cherry orchard at Larbaa Nath Irathen. Indeed, adults have appeared in the orchard during the second week of May, their presence is revealed until the beginning of October (2009). The number of individuals increases to reach its maximum in August (55 individuals). The appearance of adults is governed by the environmental temperatures. In 2011, first appearances are detected at 16.4°C, the number of individuals peaked at 26.5° C. The duration of oviposition was 82 days from mid-June to the first week of September, the maximum egg laid was recorded on August 9 (596 eggs). The incubation time under controlled conditions is 17 days. It would be interesting to complete this study by others more extensive to get more information about the spatio-temporal fluctuation in populations of *C. Tenebrionis* in the study area and other regions of Algeria.

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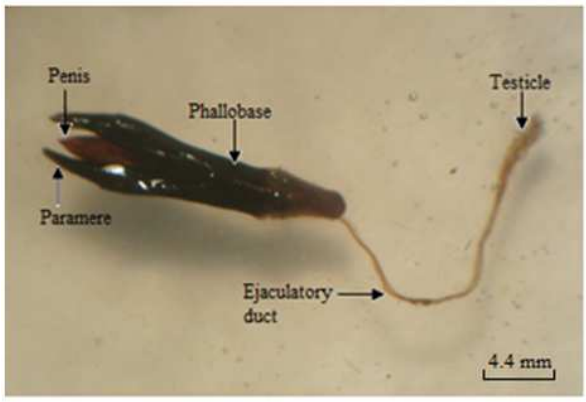
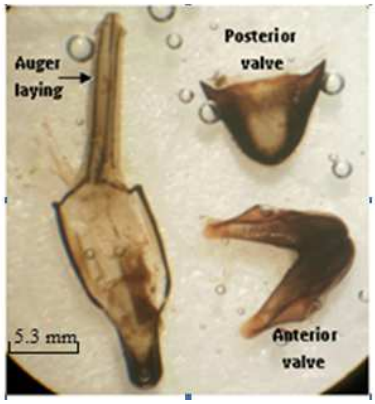
APPENDICES

Figure 4: Eggs of *C. tenebrionis* (Original) **Figure 5: Neonatelarva of *C. tenebrionisz* (Original)**





a. Male **b. Female**

Figure 6: Genitalia of *Capnodis tenebrionis* (Original)